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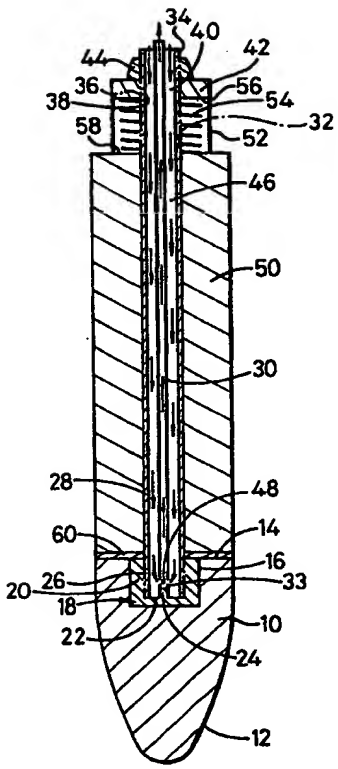
(54) Title: A PLUNGER OR STIRRER FOR USE IN THE MANUFACTURING OF GLASS ARTICLES

(57) Abstract

The present invention provides a component, particularly a plunger or stirrer, for use in the manufacture of glass articles such as bottles, which component comprises a ceramic tip, an elongate, hollow metal support member, fixing means for fixing the tip to the support member, and cooling means for causing or allowing a cooling fluid to flow interiorly of the support member for cooling the same. Typically the tip will be manufactured from a suitable glass contact refractory material and can be accurately dimensioned and finished.



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A PLUNGER OR STIRRER FOR USE IN THE MANUFACTURING OF GLASS ARTICLES

The present invention relates to a component for use in a manufacture of glass objects, particularly hollow objects such as bottles and other containers. The invention has particular reference to plungers and stirrers that are used for handling molten glass. The present invention also embraces apparatus and methods for making glass bottles and containers that incorporate or use components according to the present invention.

In the manufacture of glass bottles or containers, molten glass is allowed to flow downwardly in channels into a feeder bowl that is fitted, in its bottom wall, with an orifice ring. Said orifice ring defines one or more holes, and molten glass in the feeder bowl debouches the hole(s) in the orifice ring in semi-molten form. The feeder bowl also accommodates one or more reciprocating plungers, each having a tip portion that is continually moved into engagement with the orifice ring, so as intermittently to obturate a respective one of the holes. As a result, the semi-molten glass emerges from the orifice ring in gobs, each gob having a precise, pre-selected weight. There is a general trend in the art towards ever lighter,

thinner or smaller glass bottles and containers, and accordingly there is a continual need to improve the accuracy with which the gobs of pre-selected weight are produced.

The plungers used hitherto in the art are manufactured as a single piece from a glass contact refractory material, having the tip at one end and a chuck portion at an end remote from the tip for connection to a reciprocating mechanism. This is wasteful of ceramic material, and makes it difficult to align the tip accurately with the respective hole in the orifice ring. As a result, there is a substantial manufacturing tolerance in the production of semi-molten glass gobs to a pre-selected weight.

It is also desirable to ensure that the glass in the feeder bowl is homogeneous in both chemistry and temperature. To this end, the feeder bowl also accommodates one or more ceramic stirrers and/or rotors. As with the plungers, said stirrers and rotors are manufactured entirely of ceramic.

It is therefore an object of the present invention to provide components such as plungers and stirrers for use in manufactures of glass objects, which components

are less wasteful of ceramics as compared with the prior art plungers and stirrers.

Another object of the present invention is to provide a plunger that can be used to produce more accurately glass gobs of pre-selected weight as compared with prior art plungers.

According to one aspect of the present invention therefore there is provided a component, particularly a plunger or stirrer, for use in a manufacture of glass articles, which component comprises a ceramic tip, an elongate, hollow metal support member, fixing means for fixing the tip to the support member, and cooling means for causing or allowing a cooling fluid to flow interiorly of the support member for cooling the same.

Typically, the tip will be manufactured from a suitable glass contact refractory material, and can be accurately dimensioned and finished. The use of a metal support for the tip enables the tip to be located accurately in a feeder bowl of a glass bottle or container manufacturing apparatus, so as to engage accurately with an orifice ring for intermittently obturating a hole formed therein.

Said cooling means allows the metal support member to be used at operating temperatures that are typically in excess of 1000°C. It is envisaged that air will usually be used as the cooling fluid.

Said fixing means may comprise a metal collet having a ring portion, which ring portion is threaded to engage a cooperating thread formed on one end of the support member. Said collet may be accommodated in a rebate formed in the ceramic tip. In some embodiments, the collet may be cemented in the rebate.

Alternatively, said collet may include a threaded stem that engages a corresponding thread formed in a wall of a bore formed in the tip. The collet may include a flange that abuts on a surface of the tip juxtaposed the bore, when the stem is screwed fully into the bore. The metal collet thus allows the ceramic tip to be located accurately on the one end of the support member.

In a particular aspect of the present invention, said cooling means may comprise an elongate conduit member that is accommodated within or surrounds the hollow support member, so as to define an inner passageway within the innermost of the conduit member and support

member, and an outer passageway between the innermost and outermost of said members, interconnecting means at or towards the one end of the support member for interconnecting the inner and outer passageways for allowing cooling fluid to flow therebetween, and inlet and outlet means at another end of the support member remote from the ceramic tip for inletting cooling fluid to one of said inner and outer passageways, and for outletting said fluid from the other passageway.

Preferably, the conduit member will be accommodated within the hollow member. It is envisaged that the conduit member will normally be made from metal.

Said metal collet may include locating means for locating one end of the conduit member in the collet. Said one end of the conduit member may be open, and the locating means may comprise a protrusion that is inserted in the one open end.

Alternatively, the collet may include a socket adapted to receive the one end of the conduit member.

In another aspect of the present invention, said component may further comprise an outer ceramic sleeve

that surrounds said support member (and conduit member) for insulating the metal elements of the component. Said support member may carry a retaining means for retaining the sleeve in abutment with the tip. In some embodiments, said retaining means may comprise a cap having a threaded through-bore, which cap can be screwed onto a cooperating thread formed on the support member. Said cap may accommodate a spring means such, for example, as a coil spring that engages the ceramic sleeve for pushing the sleeve against the tip.

Said cap may include a chuck portion.

The component of the present invention may be a plunger, and said chuck portion may be adapted for engagement with a reciprocating mechanism. Alternatively, the component may be a stirrer or rotor, and the chuck portion may be adapted for engagement with a rotating mechanism.

Following is a description by way of example only with reference to the accompanying drawings of methods of carrying the present invention into effect.

In the drawings:-

Figure 1 is a side view, partly in cross-section, of a plunger in accordance with the present invention.

Figure 2 is a side view, in cross-section of a fixing device for a component according to the present invention.

Figure 3 is a side view, partly in cross-section, of a stirrer according to the present invention.

Figure 4 is a side view, partly in cross-section, of a rotor according to the present invention.

The plunger shown in Figure 1 comprises a solid tip (10) that is manufactured from a glass contact refractory material. Said tip can be made by any one of a number of different processes which will be known to persons skilled in the art such, for example, as ethyl silicate bonding or casting, or phosphate bonding methods that obviate the need for substantial heating - see e.g. EP-A-0501662. The tip may be manufactured by slip casting or by isostatic pressing and machining. In any case, the tip is accurately dimensioned and finished with a tapered nose portion (12) that is adapted to engage an orifice ring in a feeder bowl of a glass bottle or container

manufacturing apparatus, in order to obturate a respective aperture formed in said orifice ring.

Opposite the tapered nose portion (12), the ceramic tip (10) is formed with a circular, planar end surface (14). Centrally of the end surface (14), the tip is drilled to provide a rebate (16) of circular cross-section, which rebate accommodates a metal fixing device (18). Said fixing device (18) is cemented in the rebate (16) and comprises an internally threaded ring portion (20) and an end wall (22) that abuts on the blind end surface of the rebate (16). Said end wall (22) is formed centrally with a cylindrical lug (24) that protrudes from the end wall interiorly of the ring portion (20).

Said ring portion (20) engages with one end (26) of an elongate support tube (28). Said support tube (28) is made of metal, usually heat resistant stainless steel, and is externally threaded at the one end (26) to mate with the internal thread of the ring portion (20). The support tube (28) accommodates a second relatively narrow, elongate tube (30). Said second tube (30) will also usually be made of stainless steel and is located at its one end (32) on the lug (24). Said fixing device (18) thus serves accurately to locate

the support tube and second tube in relation to the ceramic tip (10).

Remote from the one end, the support tube is externally threaded at (32) juxtaposed another end (34) of the tube. Said external thread (32) engages a cooperating thread (36) that is formed in a wall (38) of a through-bore (40) formed in a chuck cap (42). said chuck cap (42) can thus be secured to the other end (34) of the support tube (28), and is locked in place with a locking nut (44). Said chuck cap (42) is configured to provide a connection for the plunger to a reciprocating mechanism in a molten glass feeder bowl.

Said support tube (28) and second tube (30) are both open at the other end (34). The two tubes define therebetween a passageway (46) of annular cross-section that can be connected to a supply of a cooling fluid, preferably compressed air. The one end of the second tube (30) (or optionally the lug (24)) is perforated (48) so that the bore of the second tube (30) communicates with the annular passageway (46). The cooling fluid can thus be caused or allowed to flow continuously along the annular passageway (46), and return interiorly of the second tube (30), for

cooling the metal components of the plunger during operation of the glass container making apparatus.

For some applications, additional protection may be required for the metal components, and for this purpose the plunger may include an optional ceramic sleeve (50) that is annular in cross-section and surrounds the metal support tube (28) as shown in Figure 1. Said chuck cap (42) incorporates a ring-like skirt portion (52), which skirt portion (52) accommodates a compression spring (54). Said compression spring (54) acts between a flange portion (56) of the chuck cap (42) and the other end (58) of the sleeve (50). Said compression spring (54) thus urges the sleeve (50) into abutment with the planar surface (14) of the tip, whilst accommodating differential expansion of the metal and ceramic components of the plunger in use. The ceramic sleeve (50) thus serves to insulate the support tube (38) and second tube (30) from ambient heat in the feeder bowl during operation. In order to ensure a good connection between the ceramic sleeve (50) and the tip (10), a ceramic fibre washer (60) may be interposed between the planar surface (14) of the tip and the one of the sleeve (50). A second washer (not shown) may be interposed between the other end (58) of the sleeve

and the compression spring (54) if desired.

The fixing device (18) thus ensures that the tapered portion (12) of the tip (10) can be aligned precisely with the respective hole in the orifice ring, thereby to ensure that the gobs of semi-molten glass debouching the orifice ring are formed accurately to the pre-selected weight within a small tolerance. It is preferred that the interengaging threads formed on the one end of the support tube (28) and the ring part (20) of the fixing device (18) are coarse threads, so as to allow the tip (10) to be easily unscrewed from the support tube (28) for replacement when necessary with minium down-time.

An alternative form of fixing device (118) is illustrated in Figure 2, which fixing device is manufactured as a single piece from heat resistant steel. Said fixing device (118) includes, at one end, a first externally threaded stem portion that can be screwed into an internally threaded bore formed in the tip (10), centrally of the circular, planar end surface (14). Said first threaded stem portion (120) terminates remote from the one end of the fixing device (118) contiguous an annular flange portion (122). On fitting the fixing device (118) onto the

tip (10), the threaded stem (120) is screwed into the threaded bore of the tip, until the flange portion (122) abuts on the planar end surface (14) of the tip. If desired, a ceramic fibre washer (124) can be interposed between the flange portion (122) and the tip (10). Remote from the threaded stem (120), said flange portion (122) is contiguous a shoulder portion (126). At its other end, the fixing device (118) includes a second, externally threaded stem portion (128), which second stem (128) is connected to the shoulder portion (126) by a short neck portion (120).

Said fixing device (118) is drilled to provide a blind bore (132) that is open at the other end (134) of the device (118), and extends axially of the device (118) to terminate just short of the one end (136) of the device. Said bore (132) is circular in cross-section, and is uniform along its length, tapering to a point (38) at its closed end.

Said blind bore (132) is designed to accommodate the one end of the second conduit tube (30), for locating the same in the fixing device (118). Said one end of the second tube (30) is square to its longitudinal axis, such that it cannot extend into the tapered end

portion of the bore. Compressed air or other cooling fluid passing through the interior of the second tube (30) can thus escape through the open one end of the second tube into the tapered end of the blind bore (132), and bleed back between the fixing device (118) and the exterior of the second tube (30), for cooling the fixing device (118) and second tube (30) towards the one end thereof.

Said second threaded stem portion (128) is designed to engage an internal thread formed on the one end of the support tube (28), which support tube (30) can thus be screwed onto the second threaded stem (128) until the one end of the support tube (28) abuts the other side (140) of the flange portion (122). Said shoulder portion (136) forms a close fit in the one end of the support tube (38), for positively locating the support tube (28) on the fixing device (118).

The alternative fixing device (118) is incorporated in the stirrer (200) illustrated in Figure 3. Said stirrer (200) includes a ceramic tip (210), that is not tapered like the plunger tip (10), but instead is formed with a helix formation (212). Said first threaded stem (120) of the fixing device (118) can be screwed into a threaded bore formed in the other end

(214) of the stirrer tip (210) in the manner as hereinbefore described. Said fixing device (118) is further fitted with a support tube (28) and second inner tube (30) for mounting the stirrer tip (210) and for supplying cooling fluid such, for example, as compressed air interior of the support tube (28) for cooling the same. Said support tube (28) is fitted with a chuck part (42) at its other end remote from the stirrer tip (210), which chuck part (42) is adapted for connection to a rotary mechanism for rotating the stirrer in a feeder bowl of a glass container manufacturing apparatus. In use, the stirrer tip (210) is immersed in molten glass in the feeder bowl, and rotation of the helix formation causes mixing of the molten glass, in order to ensure homogeneity of chemistry and temperature.

Said rotary mechanism provides unidirectional rotation of the ceramic stirrer tip (210). Preferably, the first and second stem portions (120,128) of the fixing device (118) will be threaded in the opposite direction, so that in use, the fixing device (118) tends to tighten to the tip (210) and support tube (28) rather than work loose.

The rotor of Figure 4 incorporates another alternative

fixing device (318) that is used for mounting a rotor tip (320) of glass contact refractory material. As with the fixing device shown in Figure 2, the fixing device (328) of Figure 4 includes a first externally threaded stem portion (320) that is screwed into an internally threaded bore formed in the other end of the rotor tip (320). The fixing device (318) differs from the above described fixing devices (18,118) of Figures 1 to 3 however, in that the fixing device (318) of Figure 4 allows the support tube (28) to be accommodated within the second tube (not shown) rather than vice versa. For this purpose, the other end (334) of the fixing device (318) of Figure 4 is equipped with an internally threaded ring portion (342) that accommodates the one end of the support tube (28). Said support tube (28) is externally threaded at its one end to mate with the ring portion (342). As before, the other end of the support tube (28) carries a chuck part (342) that, in this case, comprises a metal disc (364) having a drive edge (366), and a ceramic disc (368) that is bonded to the one side of the metal disc (364) to provide a heat shield. A lock-nut (344) is provided for locking the chuck part (342) on the support tube (328).

This arrangement is particularly advantageous, because

the support tube (328) being accommodated within the second tube, is kept cooler than is the case where the support tube surrounds the second tube as in Figures 1 to 3.

CLAIMS

1. A component for use in a manufacture of glass articles, which component comprises a ceramic tip, an elongate, hollow metal support member, fixing means for fixing the tip to the support member, and cooling means for causing or allowing a cooling fluid to flow interiorly of the support member for cooling the same.

2. A components as claimed in claim 1, wherein said component is a plunger or stirrer.

3. A component as claimed in claim 1 or claim 2, wherein the tip is manufactured from a glass contact refractory material.

4. A component as claimed in claim 1, 2, or claim 3, wherein said fixing means comprises a metal collet having a ring portion, which ring portion is threaded to engage a cooperating thread formed on one end of the support member.

5. A components as claimed in claim 4, wherein said collet is accommodated in a rebate formed in the ceramic tip.

6. A component as claimed in claim 4, wherein the collet includes a threaded stem that engages a corresponding thread formed in a wall of a bore formed in the tip.

7. A component as claimed in claim 6, wherein the collet includes a flange that abuts on a surface of the tip juxtaposed the bore, when the stem is screwed fully into the bore.

8. A component as claimed in claim any preceding claim, wherein said cooling means comprises an elongate conduit member that is accommodated within or surrounds the hollow support member, so as to define an inner passageway within the innermost of the conduit member and support member, and an outer passageway between the innermost and outermost of said members, interconnecting means at or towards the one end of the support member for interconnecting the inner and outer passageways for allowing cooling fluid to flow therebetween, and inlet and outlet means at another end of the support member remote from the ceramic tip for inletting cooling fluid to one of said inner and outer passageways, and for outletting said fluid from the other passageway.

9. A component as claimed in claim 8, wherein the conduit member is accommodated within the hollow member.

10. A component as claimed in any preceding claim, wherein said collet includes locating means for locating one end of the conduit member in the collet.

11. A component as claimed in any preceding claim, wherein said component further comprises an outer ceramic sleeve that surrounds said support member for insulating the metal elements of the component.

12. A component as claimed in claim 11, wherein said support member carries a retaining means for retaining the sleeve in abutment with the tip.

13. A component as claimed in claim 12, wherein said retaining means comprises a cap having a threaded through-bore, which cap can be screwed onto a cooperating thread formed on the support member.

14. A component as claimed in claim 13, wherein said cap accommodates a spring means that engages the ceramic sleeve for pushing the sleeve against the tip.

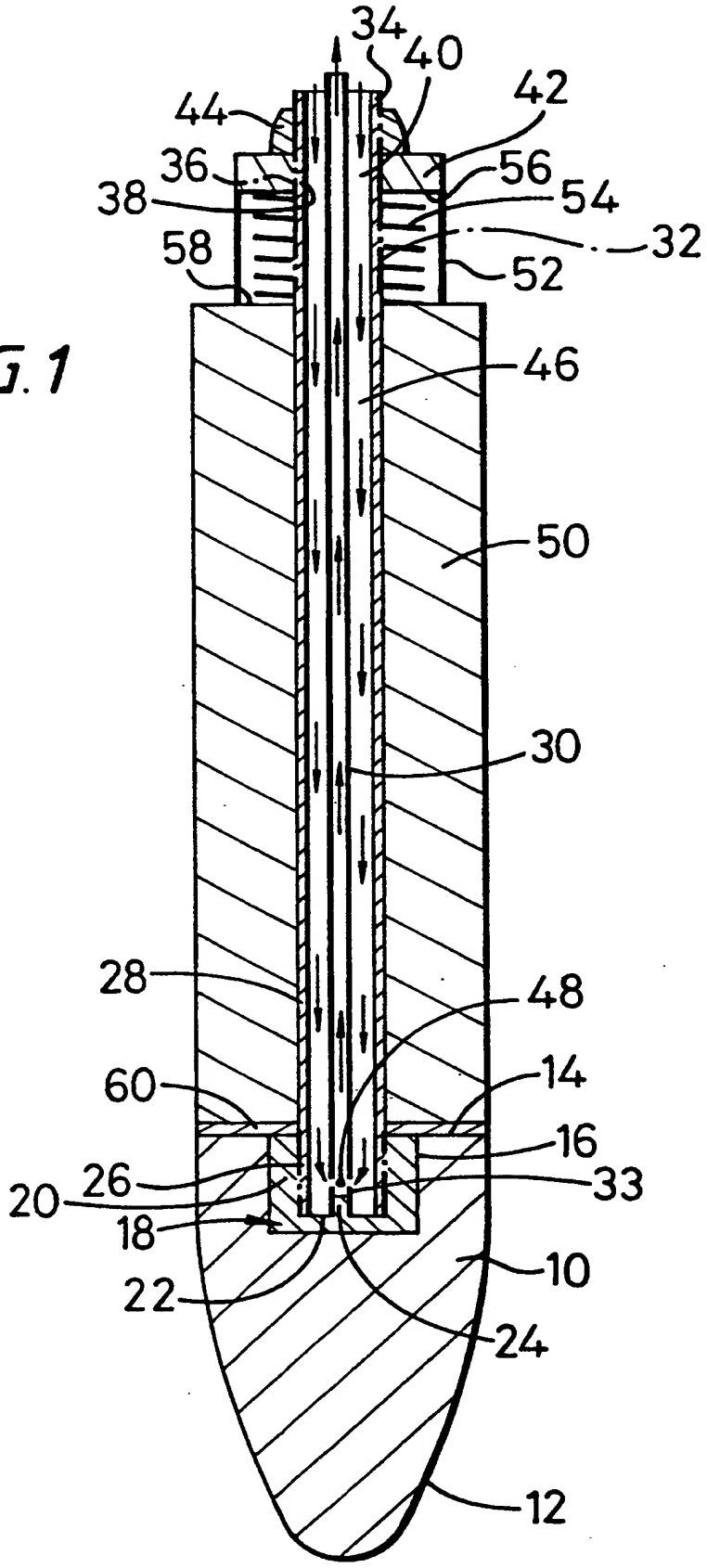
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FIG. 1

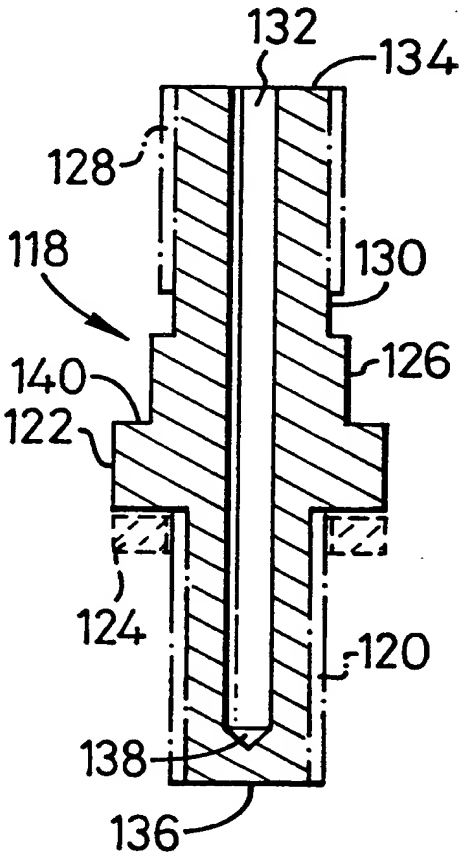
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FIG. 2

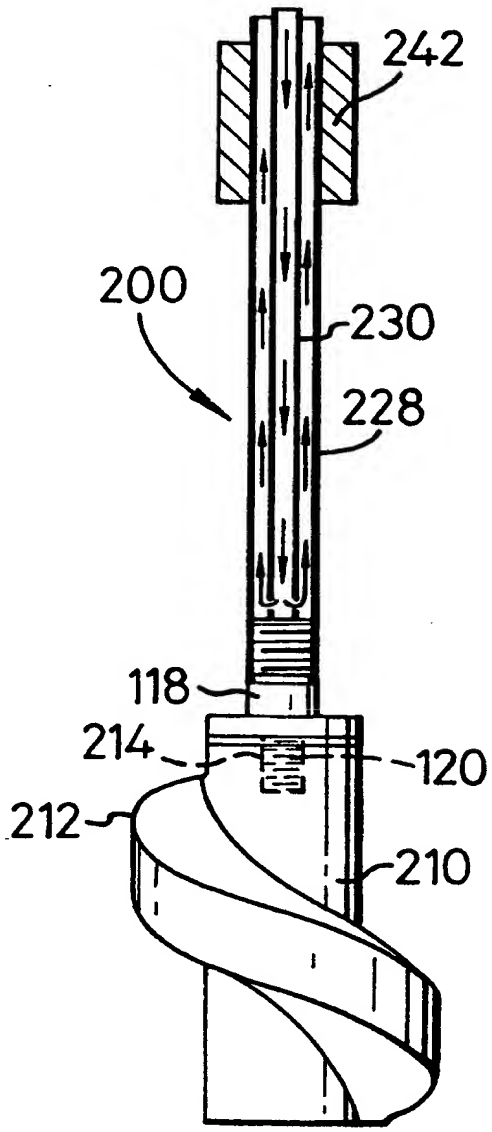
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FIG. 3

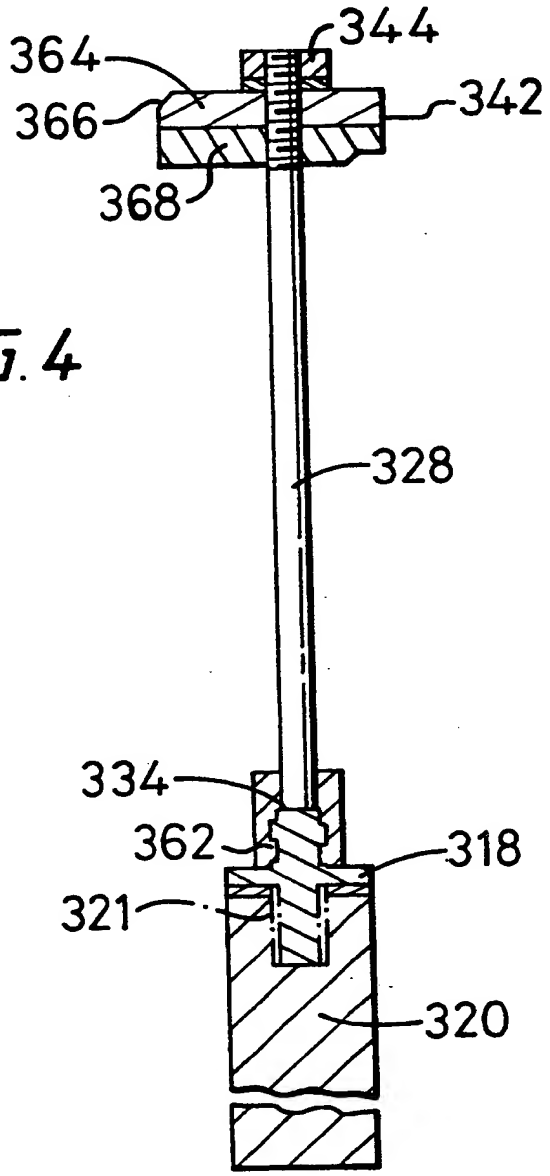

FIG. 4

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 98/00513

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C03B5/187 C03B7/086 C03B5/167

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 539 691 A (LUCEK) 10 November 1970 see the whole document	1-14
A	DE 889 337 C (TANBERG) 30 July 1953 see the whole document	1-14
A	FR 907 713 A (TELEFUNKEN GESELLSCHAFT) 20 March 1946 see the whole document	1-14

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Date of the actual completion of the international search	Date of mailing of the international search report
4 June 1998	12/06/1998

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

..formation on patent family members

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